DOCUMENT RESUME

ED 444 500 IR 020 156

AUTHOR Aris, Baharuddin; Abu, Mohd Salleh; Ellington, Henry; Dhamotharan, Mogana

TITLE Learning about Information Technology in Education Using Multimedia.

PUB DATE 2000-00-00

NOTE 7p.; In: Society for Information Technology & Teacher Education International Conference: Proceedings of SITE 2000 (11th, San Diego, California, February 8-12, 2000). Volumes 1-3; see IR 020 112.

PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS Computer Software Development; *Computer Uses in Education; *Courseware; Curriculum Development; Educational Technology; Foreign Countries; Higher Education; *Information Technology; *Multimedia Materials; Teacher Attitudes; Teacher Education

IDENTIFIERS Technological University of Malaysia

ABSTRACT

The Malaysian Ministry of Education has given adequate opportunity for teachers to acquire knowledge and skills in operating computer and information technology (C&IT) in order to fully utilize C&IT in the learning and teaching process, as well as in the daily running of the school. Realizing the vision of the ministry, Universiti Teknologi Malaysia's teacher education curriculum was reinvented. New, efficient, and cost-effective learning methods were used to supplement conventional teaching methods. Computer-based learning (CBL) materials were used because many research studies that looked into the effectiveness of CBL on adult learning about information technology have proven to be successful. Based on this observation, the possibility of improving Malaysian adult teachers' knowledge of and attitude to IT in education by giving them access to a flexible and user-friendly interactive multimedia courseware package, Computer-based Educational Resource and Development in Information Technology (CERDIk IT), is examined. (Author/MES)

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ED 444 500

LEARNING ABOUT INFORMATION TECHNOLOGY IN EDUCATION USING MULTIMEDIA

Baharuddin Aris
Department of Educational Multimedia
Universiti Teknologi Malaysia
Malaysia
bba@tm.net.my

Mohd. Salleh Abu
Department of Science and Mathematics Education
Universiti Teknologi Malaysia
Malaysia
Salleh@fp.utm.my

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G.H. Marks

Henry Ellington
Centre for Learning and Assessment
The Robert Gordon University
Scotland
h.ellington@gru.ac.uk

Mogana Dharnotharan
Department of Language Education
Universiti Malaya
Malaysia
mogana@fp.um.edu.my

Abstract: The Malaysian Ministry of Education has given adequate opportunity for teachers to acquire knowledge and skills in operating the computer and information technology (C&IT) in order to fully utilised C&IT in the learning and teaching process, as well as, in the daily running of the school. Realising the vision of the Malaysian Ministry of Education, Universiti Teknologi Malaysia's teacher education curriculum was reinvented. New, efficient and cost-effective learning methods were also used to supplement conventional teaching methods. Computer-based learning (CBL) materials were used because many research studies that looked into the effectiveness of CBL on adult learning about IT have proven to be successful. Based on this fact, is it possible to improve Malaysian adult teachers' knowledge of and attitude to IT in education by giving them access to a flexible and user-friendly interactive multimedia (IMM) courseware package – Computer-based Educational Resource and Development In Information Technology (CERDIk IT)?

INTRODUCTION

Ellington (1995) believed that multimedia personal computers (MPC) have the potential to make a very significant contribution to the educational field. Interactive multimedia (IMM) courseware, therefore, has the potential to enhance learning by creating a realistic and appealing presentation of virtually any subject matter. Although the benefits of this learning technology have been documented, it appears that this educational resource has been under utilised for educational development, particularly for adult learners.

Szabo (1996, p. 219) made a point that "interactive multimedia is so new there is little research on it as a whole". This statement is supported by Thompson, Simonson and Hargrave (1996). In their book,

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"Educational Technology: A Review of the Research", they confirmed that not a great deal of IMM research has been conducted in education. Therefore, it is not surprising that very few research studies are available related to adults learning about C&IT- both on cognitive and non-cognitive outcomes (Baldi, 1997).

THE RESEARCH STUDY

Many research studies that looked into the effectiveness of computer-based learning (CBL) materials on adult learning about computer and information technology (C&IT) have proven to be successful. Based on this fact, is it possible to improve Malaysian teachers' knowledge of and attitude to C&IT in education by giving them access to a flexible and user-friendly IMM courseware package?

A formal and comprehensive research study was thus conducted at Universiti Teknologi Malaysia (UTM) to supplement the existing body of research related to the use of an interactive learning technology and adult learning about C&IT. The research study was in line with the thinking of several prominent figures in the area of educational technology.

For instance, according to Percival, Ellington and Race (1993, p. 3):

> "... many people became aware that there was much in education and training which could be improved by thinking more carefully about *all* aspects of the design of teaching/learning situations. Such considerations led to a new, broader interpretation of 'educational technology' as the entire technology *of* education and training rather than merely as the use of technology *in* education, with the latter being regarded as merely a part of the former rather than the whole field..."

The objectives of the research project are as follows:

- To determine the content of an IMM courseware package (in a CD-ROM stand-alone format) through teachers' needs analysis, experts' opinions and the Internet.
- To develop a user-friendly prototype IMM courseware package (based on the ADDIE Model, which incorporates adult learning principles, instructional design principles and software engineering principles) regarding IT and its application to the field of education in Malaysia.
- To conduct formative evaluation via a pilot study in order to produce a fully-tested IMM courseware package (in a CD-ROM stand-alone format) which caters for different existing knowledge levels and attitudes and preferred learning styles on the part of the teachers.
- To conduct summative evaluation via a full experimental study in order to measure any significant improvement in teachers' knowledge of and attitude to IT as a result of being exposed to the IMM courseware package (in a CD-ROM stand-alone format).

The systematic methodology underlying the production of the IMM package was based on analysis, design, development, implementation and evaluation (*ADDIE*) model (Molenda, Pershing and Reigeluth, 1996), and incorporated adult learning principles, instructional design principles and software engineering principles (Aris, Abu, Ellington and Mogana, 1999). This research project thus involved the preliminary needs analysis, design, development, implementation and evaluation of an IMM courseware package at UTM.

Prior to the production of an IMM courseware package, both the objectives and the content to be included in the IMM courseware package were determined by analysing the needs of adult practising teachers. These needs were later compared with experts' opinions. Experts' views were obtained through books, interviews and via the Web. Based on a detailed and comprehensive analysis, appropriate and essential content was included in the IMM courseware package. The package offers information related to the general overview of C&IT, Malaysian Multimedia Super Corridor (MSC) and Smart Schools, history of the computers, computer hardware and software, communication and networking, and significant applications of C&IT in education (Aris, Abu, Ellington and Dhamotharan, 1997).

Instructional design principles include aspects such as instructional strategies and instructional presentations. An essential feature in any IMM courseware package is interactivity. This capability, as manifested by features such as clicking and touching, click-able objects, push buttons, scroll bars and moving objects was fully built into the package. Many of the screens in the package contain several navigational buttons to help the adult student teachers to move about within the system. These buttons give the adult learner the choice as to whether to process the information linearly using the 'Forward' and 'Back' buttons (Graphical User Interface), or on a 'need to explore' basis by using the 'Topics' button (Text User Interface). An 'Exit' button (Graphical User Interface) affords immediate exit capabilities. The navigation buttons were placed in the same relative positions on all appropriate pages. The 'Forward', 'Back' and 'Exit' buttons were placed at the lower right, to ensure ease of interface and consistency, while the 'Topics' button were placed in the upper left hand corner of the screen. This standardisation proved to be of considerable assistance in ensuring that the package was 'user-friendly'. Another extremely powerful aspect of multimedia is the ability to convey information and create an impact on the learner through the effective use of several audio-visual elements. The overall audio-visual layout design in the courseware was consistent with respect to style and format objects.

CERDIk IT, which stands for *Computer-based Educational Resource and Development In Information Technology*, is a Malay word for 'IT Intelligent' (Aris, Abu, Ellington and Mogana, 1998). Under this acronym, the first CERDIk IT package titled 'IT in Education' was produced with the main purpose of improving teachers' knowledge and changing their attitudes toward the use of C&IT in education. This user-friendly, easy-to-use and IMM courseware package was designed and developed by Baharuddin Aris. This IMM multimedia courseware package will henceforth be referred to simply as the CERDIk IT.

Macromedia Authorware version 4.0 was the authoring software chosen to develop the CERDIk IT. This software uses icon flowcharts and a drag-and-drop flowcharting metaphor. Instructions are obtained from dialog boxes with pull-down menus. This particular system was selected because it was user-friendly, and provided all the basic facilities that were required. Simple and readable text was used in the package. The computer graphics created in the package was used to support the content. The graphics and animation software used in the CERDIk IT included a very simple and user-friendly software called Ulead Cool 3D and the more advanced 3D Studio. Digitised still images file types used in the production of the CERDIk IT were bitmaps (.BMP), CompuServe GIF (.GIF) and Joint Experts Photography Group (.JPG). To create images from an external source, a scanner and a digital camera was used. These still images were used to enhance the appearance and to support important messages in the CERDIk IT. Digital audio format used in the development of the package was wave (.WAV). A SoundBlaster 16 sound card was used to digitise analogue audio recorded via a microphone. Sound Forge was used to edit digitised audio and add special effects to it. The analogue video footage was recorded using a video cassette recorder. It was then converted into digital format using a Video Blaster IE500 video capture card. Adobe Premiere was used to edit digitised video and add special effects to it. The digital video formats used in the development of CERDIk IT were Quick Time Movies (.MOV) and Video for Windows (.AVI). Digital video requires much more hard-disk storage space than any other form of medium. For example, a digital video clip in the CERDIk IT courseware package that runs for 20 seconds on the AVI (Video for Windows) format took up 44.9 Mb of hard-disk space. The digital video will require a smaller hard-disk storage space if it is converted to Quick Time Movies (.MOV) format.

The prototype version of the CERDIk IT was evaluated during its design and development phase (formative evaluation). Changes were made on the prototype version. prior to summative evaluation. Summative evaluation was conducted to determine its effectiveness in a university setting.

The sample selected for the research study consisted of 72 adult student teachers, mostly females. They had undergone a post-graduate diploma in education programme at UTM. They are generally in the age range of mid 20's to late 30's. These teachers have usually been in school for several years, and have taught subjects such as English, Mathematics, Science, Biology, Business and Basic Economics.

Data were gathered utilising multiple methods in order to obtain a variety of perspectives about the topic under investigation. Therefore, research instruments such as questionnaires, observation schedule, courseware evaluation form and interviews were used in the research study.

FINDINGS

The results of the research study were based on both formative and summative evaluation of the courseware package. Both quantitative data and qualitative data were collected to determine the effectiveness of CERDIk IT and the approach used by adult student teachers in learning a particular content area using a CBL material.

Three academic staff from the Department of Educational Multimedia and three adult students at UTM participated in the formative evaluation. Comments and opinions were made based on the design and usability of the CERDIk IT prototype package, and on the validity of the courseware evaluation form. For the purpose of this paper, only brief comments by the academic staff were highlighted.

The whole program certainly followed sound instructional design principles, such as, Gagné's 'Events of Instruction'. For example, the introductory sequence was very motivating. It was able to grab hold of the users' attention. The package was also easy to operate - move forward, move backwards and exit. Guidelines in operating the package were provided at the very beginning (right after the montage) of the package, or before the main menu of the package was highlighted. However, it would have been more convenient if there had been an option to by-pass the guidelines, especially for users who had not been there for the first time. It would be very annoying for these users to see the guidelines, over and over again.

The different topics in the main menu were systematically organised. So, the users could choose either the linear approach (as prescribed by the designer), or according to their preferences, without having any worries of getting lost in cyberspace. "The users will not be lost in the cyberspace", commented one of the staff.

Even though the screen design adhered to the rule 'KISS' (Keep it Simple and Straightforward), overall, the package still looked very professional, and very pleasant to look at. In general, the package had a simple user interface. Both the text and graphical user interfaces used in the package were easy to remember, and their placements were consistent throughout the whole program. The branching did not go beyond three 'hops' to avoid a more complicated branching. This, in return, will normally make the users more confused.

In general, the graphics that were used in the package were helpful in understanding the message in the content. They also found that the quality of visual display in the package was motivating, although some pictures needed to be changed. Some of these pictures must be suitable with the message being delivered on the screen, and also, needed to be clearer. The digital video was beautiful and appropriately used.

With respect to texts, bold letters were displayed in the package, with at least a letter size of 12. There were texts in Arial Black font. The evaluators suggested that the text should use commonly-accepted fonts, such as Times New Roman. This is because not all personal computers have Arial Black font installed in them. It was good advice, because some of the letters were missing when the package was played in a personal computer without Arial Black font installed in it. Scrolling text was used with a purpose. For example, users were able to scroll the objectives of the package with ease and speed, without having to move from one page to another, with the intention to recall the objectives of the package. So far, it was not easy to 'crash' the program.

Overall, the CERDIk IT package, even at the prototype stage, was very easy to use and very interesting to learn with. Apart from the comprehensive content, the package was able to hold the users' attention throughout the program. All of the staff agreed that the CERDIk IT could be used as part of the course 'IT in Education' at UTM.
The overall findings from the summative evaluation revealed that, as a consequence of being exposed to the CERDIk IT as self-directed learning approach, many of the participants admitted that their knowledge about and attitudes toward C&IT improved significantly.

Based on the quantitative data collected in the research study, the CERDIk IT promoted significant amounts of learning during the pre-test to the post-test interim at 0.05 level of significance (pre-test: mean = 2.50; post-

test : mean = 4.01; t value = 11.41). This clearly shows that the adult students have become highly *knowledgeable* with respect to C&IT and its applications in education.

Adult student teachers' attitudes toward the content 'IT in Education' was positive. The post-test scores were significantly higher than the pre-test scores at the 0.05 level of significance (pre-test : mean = 3.23; post-test : mean = 4.43; t value = 14.65). They considered the content *useful* to their career, after using the CERDIk IT. Adult student teachers also believed that CBL packages, such as the CERDIk IT, could be *effective* in delivering the content 'IT in Education'. Evidence has shown that the post-test scores acquired from the student teachers were significantly higher than the pre-test scores at the 0.05 level of significance (pre-test : mean = 3.04; post-test : mean = 4.34; t value = 18.83. Student teachers were more *willing* to use CBL package for self-directed learning. Post-test scores derived from the student teachers were significantly higher than the pre-test scores at the 0.05 level of significance (pre-test : mean = 2.53; post-test : mean = 4.40; t value = 19.20.

Additional research findings, based on qualitative data, disclosed that most of the student teachers interviewed found the CBL method exciting, easy to use, flexible and helpful for autonomous self-directed learning. They unanimously agreed that conventional lecture can be improved by coupling it with the CBL method.

Observing several groups of adult students using the CERDIk IT, the approached used by the adult teachers in learning using CBL materials was identified. Based on the results in the study, most of the students approached via the same strategy (linear or serialist) when using the package. All of them looked at the overall picture (holist) of the package first, before choosing their preferred topics.

CONCLUDING REMARKS

The data derived from the research study is consistent with recent findings in the use of interactive multimedia courseware as a learning and information tool in academia and corporate staff development. Therefore, the CERDIk IT (in the form of a CD-ROM stand-alone) has demonstrated its capabilities and potential as a support learning material in the ever-changing learning technological world.

RECOMMENDATIONS

UTM, particularly the Faculty of Education, not only has a teacher education curriculum that is C&IT-based in nature, but the techniques of delivering learning materials to its students are C&IT-based as well. This is because the successful use of C&IT in schools requires the student teachers themselves to be aware, knowledgeable and competent in the use of such learning technology.

Two lecturers who are experienced in designing and producing interactive multimedia courseware, Jamalludin Harun and Zaidatun Tasir who are under the Department of Educational Multimedia at UTM, have implemented the CERDIk IT with their students. CERDIk IT was used during the second semester of the 1998/99 session with students sitting for a two-credit course in 'Information Technology in Education'. The delivery method consisted of lectures, with the package being used as one of the supporting materials. Based on these lecturers' observations, they were delighted that the package was very helpful in their classes. They would definitely recommend its use to other Malaysian student teachers, inside or outside UTM, and also to Malaysian schools' practising teachers. Furthermore, these two lecturers also recommended that a nation-wide staff development programme should be implemented, with the CERDIk IT as a support learning material. They added that nation-wide research should also be conducted for greater generalisation of results in relation to the effectiveness of multimedia-based learning experiences among Malaysian student teachers, as well as, Malaysian adult practising teachers.

Apart from designing and developing interactive multimedia courseware on a CD-ROM stand-alone format, the Faculty of Education has also taken the initiative to implement the use of Web-based learning materials in

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C&IT-related courses. Lecturers under the Department of Educational Multimedia, such as Mohamad Bilal Ali, Rio Sumarni Shariffudin and Manimegalai Subramaniam, have developed courses on the Web. These on-line courses can be located at *Cyberdidik*, http://161.139.52.251. For the purpose of on-line learning, CERDIk IT should also be converted and implemented in the Web-based learning environment. This alternative approach will further enhance the flexibility of adult student teachers learning using CERDIk IT.

To complement these on-line courses, formal research has been initiated by Noraffandy Yahaya to determine the effectiveness of his *Web-based integrated Learning* (*WiLL*) development tool. Lecturers at UTM will thus be able to use the WiLL in the design and development of on-line courses in their area of specialisation. In addition, easy retrieval of educational resources from databases should also be developed. Thus, a *Management Information Resource System* (*MIRS*) will be initiated by Mat Jizat Abdol.

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